

Advanced Materials and Processes Address Needs Across Industries

Industrial processes require materials to perform under demanding thermal cycling, wear, and corrosive environments

Objective: • Develop advanced materials and processes in support of improved industrial processes

Benefits:

- Increased energy efficiency in processes, including chemicals production, die casting, forging, and heat treating of steel sheet and components
- Reduced wastage and rework through improved quality of wear-resistant coatings and corrosion-resistant advanced alloys

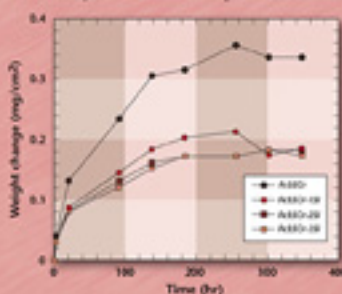
High-energy flux processing including Infrared technologies for hardening, softening, and tempering operations



Preheating of dies

Die gradient softening

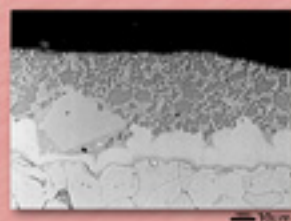
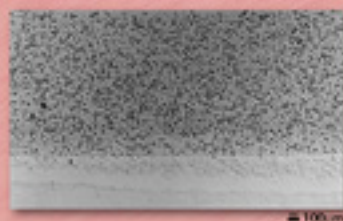
Corrosion-resistant alloys improve industrial processes



Advanced Fe-Cr-Si alloys are oxidation resistant at 800°C



Components selectively coated with wear-resistant tungsten carbide



Wear- and corrosion-resistant coatings can be selectively and quickly metallurgically bonded to substrates

Status:

- High-Energy Flux Processing—Infrared technology
 - Die gradient softening demonstrated
 - Diffusion-bonded interfaces for WC and Cr₂C₃ coatings demonstrated
- Alloy Development
 - Fe-Cr-Si components are successfully completing nearly one year of tests in glass-manufacturing operations

Participants:



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Advanced Materials/Processes

Development of advanced materials and processes can result in large savings in energy and product life cycle cost for a large number of vision industries.

Goal: Develop advanced materials and processes in support of improved manufacturing processes for all of the vision industries. Specific developments include infrared based processing, development of corrosion resistant Fe-Cr-Si and Ni-Mo alloys, and advanced versions of Alloy 800.

Manufacturing processes for nearly all industries require materials to perform under demanding conditions of thermal cycling, wear, and corrosive environments. Advanced materials and processes can impact materials needs both within and between industries. The development of corrosion resistant materials is critical for improving energy and operational efficiencies of processes, and environmental benefits. Fe-Cr-Si alloys are being developed which have superior corrosion resistance in various applications in the glass industry, new advanced nickel based alloys and composites have application in many processes in the chemical industry. The development of advanced materials processing technologies with materials development can also lead to significant process improvements and materials with improved properties. High energy flux processing including infrared technologies can lead to highly efficient process improvements. In applications, including hot forging and die casting, thermal fatigue related die failure can be minimized by efficient and rapid reproducible preheating of dies. The wear of the components can also be significantly reduced by applying diffusion bonded coatings of carbides including WC, Cr₂C₃ or combinations of them. Unique and high quality coatings can be produced by the use of carbide slurries, carbide felt, and their rapid fusing with high flux infrared based heating systems. The combination of advanced materials and processes development have applications in energy and product life cycle improvements in many industries.

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